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Unexpected Resting Behaviour in a Geriatric Zoo Elephant

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Introduction

Although observational data on natural resting behaviour in free-ranging Asian elephants (*Elephas maximus*) are lacking, lying rest is considered essential and may be used as a welfare indicator under captive conditions (Asher *et al.* 2015). Actual requirements of lying rest in elephants have not been determined, but the expression of this behaviour seems to decrease with age (Fig. 1a). Due to impaired musculoskeletal strength and degenerative joint disease, geriatric elephants are often observed to avoid lying rest completely (Wuestenhagen *et al.* 2000; Roocroft 2005; Kandler 2010; Braidwood 2013). Instead, they express a higher amount of standing rest possibly as a substitute for lying rest (Fig. 1b).

Considering the scarcity of quantitative data, each additional case report may enhance our understanding of restorative sleeping behaviour in elephants. Within the scope of a welfare assessment, we were able to investigate the nocturnal resting behaviour of a geriatric zoo elephant. It was the aim of our observations to quantitatively evaluate this individual's resting behaviour.

Material and methods

The subject of our study was a female Asian elephant born in Sri Lanka in 1952 and living in a Safari Park in the UK (van Wees & Damen 2016). Before this single kept elephant was moved to her current location in 2011, she had travelled with a performing circus for more than 50 years without any contact to further elephants during the last

20 years (Ellicott 2016). Due to the elephant's age and presumed severe arthritis mainly in both knee joints, it was decided not to bring another elephant in (Ellicott 2016). The elephant shares her exhibit, consisting of a sand-floored indoor and a greened outdoor exhibit, with three Anglo-Nubian goats. During observation nights, access was mostly restricted to the indoor area due to low ambient temperatures.

A video monitoring system was in place and provided data for our observations. Indirect observation by camera recordings was conducted between the 27th of November 2016 and the 19th of April 2017 for a total of 20 nights (18:00–8:00). Observations took place on a cluster of consecutive nights (on average 6.67 ± 4.16 nights) with several weeks between such clusters. Data were collected by continuous sampling (Altmann 1974) accurate to the minute. Lying rest was defined as lying motionless on the ground in a recumbent position. For each lying bout, the side on which the elephant lay was recorded. Total duration of lying rest was calculated for each night, as well as the average duration of lying bouts.

Results

On the video recordings the elephant was visible at all times and image quality allowed unambiguous identification of the behaviour. The elephant had one or two bouts of lying rest during each night, ranging in duration between 50 and 535 minutes. In total, 30 bouts of lying rest were observed with a mean duration of 314.3 ± 152.3 minutes. In 15 bouts the elephant chose her left side to lie on, i.e. exactly 50% of

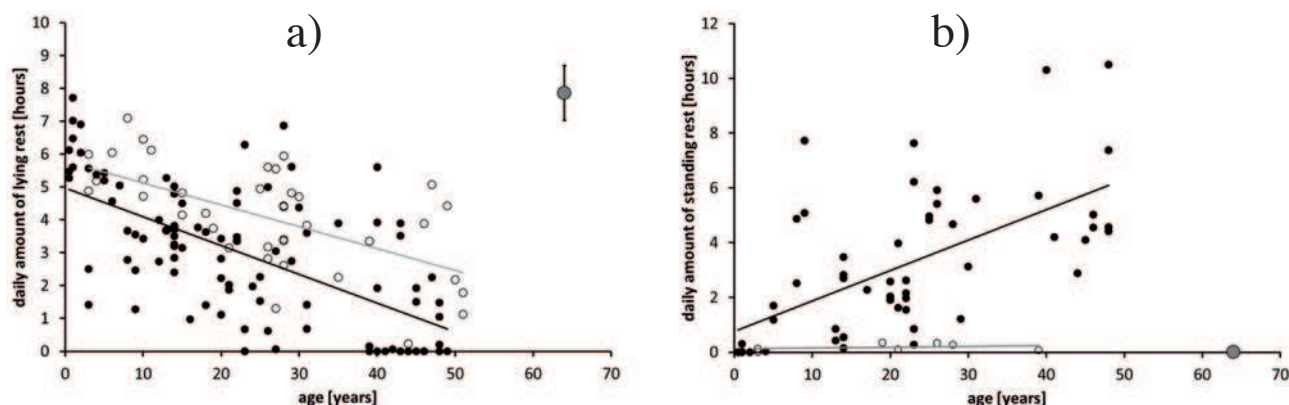


Figure 1. Correlation between daily amount of (a) lying and (b) standing rest and age in circus (circles and regression line in grey) and zoo (filled circles and regression line in black) elephants (*Elephas maximus* and *Loxodonta africana*) and the outstanding position of the observed elephant (grey circle) (literature data reviewed in Schiffmann *et al.* (2018)).

the cases (Table 1). On average the animal slept for 471.6 ± 49.9 minutes each night. She had her lying rest exclusively on the moderate slopes of sand piles provided in her indoor exhibit (Fig. 2). The majority of the elephant's lying rest activity occurred between 21:00 and 7:00 (Table 1).

According to her keepers, very short lying or leaning bouts during daytime (8:00–18:00) were observed on rare occasions. During the study period no measurable time of inactively standing still, which might be classified standing rest, occurred (see also Fig. 1b).

Discussion

Although quantitative data regarding lying rest in Asian elephants are scarce and restricted to observations under captive conditions, its duration seems to decrease with increasing age (Fig. 1a). According to her year of birth indicated in the EEP-studbook, the observed female is one of the oldest elephants living in Europe (van Wees & Damen 2016). Thus, very short bouts or even absence of lying rest was expected, especially with respect to the elephant's reduced mobility due to severe arthritis. Under these premises, the extended bouts of lying rest documented here were completely unexpected. To date, no comparable amount of lying rest has been reported in elderly zoo elephants in either species (Fig. 1a).

The absence of a side preference for lying rest corroborates findings reported in the literature

(Gebbing 1959; Kurt 1960; Tobler 1992; Weisz *et al.* 2000; Wuestenhagen *et al.* 2000; Laws *et al.* 2007; Kandler 2010), as does the expression of major sleeping activity in the early hours of the morning (Kurt 1960; Tobler 1992; Friend 1999; Friend & Parker 1999; Weisz *et al.* 2000; Wuestenhagen *et al.* 2000; Kandler 2010; Ibler & Pankow 2012; Boyle *et al.* 2015; Williams *et al.* 2015; Holdgate *et al.* 2016). However, the female observed here expressed an additional peak of lying rest between 21:00 and midnight (Table 1).

It can only be speculated which factors led to the extensive lying resting behaviour in the observed elephant. Sand-flooring with slopes and mounds represents a key factor to facilitate lying rest in elephants (Roocroft 2005; Holdgate *et al.* 2016; Walsh 2017). Thus the observed pattern may be related to the availability of such features in the enclosure. Extended lying bouts might also be explained by a desire to avoid getting up



Figure 2. The elephant exclusively chose the slopes of sand piles for lying rest.

Table 1. Compilation of 30 bouts of lying rest observed during 20 nights (18:00–8.00).

Night	Lying side	Time start	Time end	Rest per bout [min]	Total rest per night [min]
1	right	21:24	5:34	490	490
2	right	20:31	5:11	520	520
3	left	21:25	23:08	103	440
	right	0:21	5:58	337	
4	left	20:08	22:27	139	526
	right	0:07	6:34	387	
5	left	20:59	0:38	219	545
	right	1:42	7:08	326	
6	right	22:22	5:37	435	435
7	left	21:03	23:06	123	437
	left	0:16	5:30	314	
8	right	21:28	5:25	477	477
9	left	22:36	23:38	62	408
	right	0:46	6:29	344	
10	right	21:32	6:01	509	509
11	right	21:30	0:45	195	457
	left	2:58	7:20	262	
12	left	23:43	6:30	407	407
13	left	22:16	7:11	535	535
14	left	22:35	0:25	110	451
	right	1:32	7:13	341	
15	right	21:52	3:27	335	496
	left	4:00	6:41	161	
16	left	22:47	7:01	494	494
17	right	22:13	6:41	508	508
18	left	22:16	23:06	50	349
	left	2:07	7:06	299	
19	right	22:18	6:33	495	495
20	left	22:14	2:01	227	452
	right	2:41	6:26	225	

and down, due to musculoskeletal alterations, although this is generally considered to cause the opposite behaviour of not lying down at all (Wuestenhagen *et al.* 2000; Roocroft 2005; Kandler 2010; Braidwood 2013). The observed female did not show evidence of problems getting back up after rest: From her lying position on the sand pile, she easily changed to sternal recumbency, pushed herself up on her front legs, and then the hind legs.

Analysis of data from the literature revealed increased lying behaviour in circus compared to zoo elephants (Benedict 1936; Gebbing 1959; Kurt 1960; Friend 1999; Friend & Parker 1999) (Fig. 1a; Schiffmann *et al.* 2018) possibly related to the structured daily routine of circus life. Although, having lived for many years at a circus, this alone might not explain the outstanding resting behaviour of this elephant. The observed pattern might rather be considered an idiosyncratic behaviour of this individual. Alternatively it can be speculated whether geriatric elephants would usually express such an extended lying rest if they were provided with a more conducive environment. Unfortunately quantitative data on lying rest in free-ranging Asian elephants is lacking as well as data for captive individuals of a similar age (reviewed in Schiffmann *et al.* 2018). Whatever the reason, extended daily lying bouts with complete weight relief of all four limbs are likely to be highly beneficial for an elephant suffering severe degenerative joint disease.

In conclusion, this case report provides evidence of extended bouts of lying rest in a geriatric zoo elephant. We consider this behaviour beneficial for an elephant's well-being and health. Installation of malleable sand-flooring for captive elephants may encourage lying rest and is strongly recommended.

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